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Comments: *From the SCS Chief*

Conservation is Key to Long-Term Profitability

The Soil Conservation Service runs an excellent voluntary soil and water conservation program. I'm proud to be named the agency's new chief.

It may take a little time to learn some of the ropes on my new job, but I am confident in my knowledge and understanding of the strong partnership between SCS and conservation districts.

I've learned firsthand how that partnership works—as a practicing steward of the soil, director of the Little Wichita Soil and Water Conservation District, area director of the Texas Association of Conservation Districts, and member of the National Association of Conservation Districts.

In these different roles I've worked with many SCS employees over the years. One thing that's always struck me is how dedicated and professional they all are.

Another thing that's clear is how important a strong technical assistance program is to getting conservation on the ground. I'm convinced that SCS must continue to provide the same level of expert technical assistance to farmers, ranchers, and others. That local contact is vital.

SCS has been a leader in promoting conservation tillage and I see SCS continuing that lead. Conservation tillage is one of the most effective ways to reduce soil erosion, control sediment, and keep other pollutants from reaching waterways.

I firmly believe that soil and water conservation is the key to long-term profitability in agriculture. It has served my family well for many years.

It's the care that my ancestors have taken of the natural resources that's keeping our livestock operation in north-central Texas profitable today.

I plan to lead SCS in helping many more people share the feelings of pride and satisfaction that taking good care of the soil, water, and other resources has given me and my family.

I believe SCS and local conservation districts working together have the natural ability to make it happen for generations to come.

Cover: Field planted to onions in Grand Valley, Colo., was laser leveled to improve the efficiency of furrow irrigation. (Photo by Tim McCabe, photographer, SCS, Washington, DC.)

John R. Block
Secretary of Agriculture

Wilson Scaling, Chief
Soil Conservation Service

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News Briefs

SCS Evaluates Technical Assistance Program

CTA works well and it *can* work even better. This is the conclusion of a new program evaluation by the Soil Conservation Service.

CTA is the Conservation Technical Assistance program administered by SCS. It is USDA's largest program for providing land users with the technical assistance necessary to plan and apply conservation practices.

The program was evaluated on the basis of data collected in 227 sample counties during 1983. The evaluation focused on direct CTA help to land users through SCS field offices. It did not cover CTA activities in area and State offices, the national technical centers, and SCS national headquarters.

A report of the evaluation, published in April, summarizes the benefits and costs of CTA and recommends ways to strengthen the program. SCS has taken several actions—and plans further changes—to carry out the recommendations.

According to the report, CTA helped apply conservation practices on 84 million acres in 1983. These practices, which SCS advocates as part of comprehensive resource management systems, are helping to conserve many natural resources. On an annual basis, they will reduce soil erosion by 131 million tons, improve water use by 3.2 million acre-feet, improve potential forage yield by 19.7 million tons, and manage 8.9 million tons of animal wastes.

Of the total $1.2 billion spent on CTA-assisted practices in 1983, the land users themselves spent $852 million. They paid more than three-fourths of the investment for erosion control, five-sixths of the investment for water conservation, and nine-tenths of the investment for forage improvement. In all, land users spent $4.40 for every dollar spent by CTA at the local level.

Benefits of the program were analyzed according to several different factors, including land use and the primary purpose of the assistance. Some of the findings include:

- On 20 million acres of cropland, CTA helped land users reduce the annual rate of erosion by 4.1 tons per acre.
- Irrigation water management practices were applied on 2.4 million acres, enabling land users to reduce the average annual irrigation rate from 3.8 to 3.0 acre-feet per acre.
- CTA helped ranchers improve the plant cover on 30.5 million acres of rangeland. Two-thirds of this land was in poor or fair condition before treatment. After treatment, more than half was in good or excellent condition.
- In cropland areas targeted for erosion control, land users reduced sheet, rill, and wind erosion on 1.2 million acres by an average of 6 tons per acre.
- In areas targeted for water conservation, CTA helped land users install irrigation water management practices on 283,000 acres. On almost four-fifths of this acreage, water application efficiency was less than 50 percent. After treatment, less than half the acreage had this low level of efficiency.

Costs of the CTA program (mostly staff time) were also analyzed according to several factors. Major findings include:

- Direct assistance to land users, which was about evenly divided between planning and application help, accounted for 59 percent of all CTA field-office time. Activities in support of direct assistance, such as interpreting resource data, accounted for 25 percent of the time. Administrative functions took 16 percent.
- CTA direct assistance through field offices represented two-thirds ($191 million) of the total CTA appropriation in 1983.
- More than two-thirds of all CTA assistance was for the National Conservation Program (NCP) priorities of erosion control and water conservation. (In 1979 these purposes accounted for about half of CTA assistance.) In targeted areas, four-fifths of CTA time was devoted to NCP priorities.
- Nationwide, 71 percent of CTA application assistance for controlling sheet, rill, and wind erosion on cropland was for land eroding at a rate greater than "T," or tolerable soil loss. In counties targeted for erosion control, excessively eroding cropland received more than 92 percent of CTA time spent on reducing erosion.
- Land users assisted by CTA received $158 million in cost sharing, nearly all from the Agricultural Stabilization and Conservation Service.

The report presents many other findings and makes six recommendations:

1. Strengthen guidelines for erosion-control assistance;
2. Clarify the definition of water conservation and CTA's role in it;
3. Improve guidelines for range-conservation assistance;
4. Increase the proportion of CTA time used for direct assistance;
5. Improve the SCS time-and-progress reporting system; and
6. Broaden future CTA evaluations.

Technical assistance from the CTA program and cost sharing from other programs are the major incentives of USDA for voluntary action to conserve nonfederal soil, water, and related resources. The report suggests that strengthening the CTA program will make these incentives more efficient in getting conservation applied where it is most needed.

The report is titled "Evaluation of Conservation Technical Assistance: Part 1, National Summary." Copies of the report and additional information can be obtained from SCS, Deputy Chief for Assessment and Planning, P. O. Box 2890, Washington, DC 20013-2890.

Jim De Quattro,
editor, Public Information, SCS, Washington, DC

SCS Helps Build Statewide Geographic Information System in Connecticut

The Soil Conservation Service is cooperating with the Natural Resources Center (NRC) of the Connecticut Department of Environmental Protection in building an automated statewide geographic information system (GIS).

SCS is providing digitized soil data, which will be used with other digitized data sets in a computer program for storing, retrieving, analyzing, and displaying data in map and tabular form.

The GIS will be used to display ecologically sensitive areas such as marshes, locate potential sites for commercial or industrial uses, show the distribution and extent of prime farmland, provide data needed for locating highway corridors and utility rights-of-way, and display other information.

The GIS can be used to find, for example, all areas of rapidly permeable soil on slopes greater than 25 percent that are forested and within ¼ mile of a stream. The areas will be displayed on the monitor and a tabular printout of information such as acreage can be created.

The soil survey data base for the Connecticut GIS will include digitized soil maps in U.S. Geological Survey (USGS) 7.5 minute quadrangle format, a published text of the soil and map unit descriptions, and a computer data base of soil properties and interpretive information for use with the soil maps. The scale-accurate USGS maps will be the base for map compilation and digitizing.

In developing the digital soil map data base, SCS is correlating the eight county soil survey areas into one statewide survey. The correlation will update the county survey data in line with current National Cooperative Soil Survey standards and provide consistency among counties.

Funding of the digitized soil data base is planned to be shared by SCS and the State of Connecticut. Costs are estimated at $1.4 million, and the work is planned to take 8 to 10 years.

Other data bases have been or are now being formatted and digitized for use in the Connecticut GIS including land use/land cover, political boundaries, drainage basin boundaries, transportation networks, and hydrography.

When all the data bases are formatted and digitized, summary statistics and interpretive maps will be available to a wide range of users and decisionmakers.

Said Philip Christensen, SCS State conservationist in Storrs, Conn., "We need to reach land use decisionmakers with soil survey information. They need to know that a soil survey exists and how to use it. Incorporating soil survey data into a statewide GIS will make the data more usable."

At the June 1984 meeting of the National Association of State Geologists in Mystic, Conn., the NRC, in cooperation with USGS in South Dakota and Washington and data processing companies, presented a demonstration of a GIS of 30 different digital sets of data for two quadrangles. It showed the integration and analysis of spatial and tabular data for 10 different applications.

SCS plans to select and purchase hardware and software for an agencywide, minicomputer-based GIS by mid-1988 and is conducting a pilot test of a microcomputer-based GIS at the field office level. The American Farmland Trust, in cooperation with SCS, is also investigating the use of a GIS with microcomputers by rural governments.

"Geographic information systems will be invaluable tools in future resource protection efforts," said Edward Sautter, SCS State soil scientist in Storrs, Conn. "A GIS can show the dynamic relationships among soil, water, and other resources much better than sets of data scattered among different agencies."

Nancy M. Garlitz,
associate editor, *Soil and Water Conservation News,* SCS, Washington, DC

Helping Conservation Decisionmakers Use 1982 NRI Data

The Soil Conservation Service has long recognized the need to inventory natural resources and their condition.

In 1958 and 1967, SCS made Conservation Needs Inventories; in 1975, the Potential Cropland Study; and in 1977, the first National Resources Inventory (NRI).

The second NRI, completed in 1982, is the most comprehensive inventory ever made of America's nonfederal soil, water, and related resources. For it, SCS employees collected natural resource data at more than 1 million sample points across the Nation.

The 1982 NRI includes information on critically eroding areas; conservation needs; land capability; sheet, rill, and wind erosion; vegetative cover and condition; wetlands; wildlife habitat; flood-prone areas; saline and alkaline areas; potential cropland; prime farmland; land use; and other resource concerns.

It is more detailed than the 1977 NRI. Data have high reliability at the level of major land resource areas, which generally cover more than one county.

The data are intended for use by conservation policy makers in Federal, State, and local agencies, agricultural industries, researchers, and others concerned with public conservation policy.

Last December, the National Research Council's Board on Agriculture sponsored a convocation in Washington, DC, to assess the uses of the 1982 NRI data.

Participants discussed how the data can be used in addressing the extent and geographic distribution of all forms of soil erosion, the use and effectiveness of conservation practices, the effect of soil erosion on agricultural productivity, the erodibility of potential cropland, and changes in land use patterns.

They made it clear that policy makers at all levels will be basing important conservation decisions on the 1982 NRI.

This summer SCS will publish a statistical bulletin that includes a summary and detailed explanation of the 1982 NRI findings and data tables. SCS employees can

use it to help Federal, State, and local officials recognize serious resource problems and act to solve them.

Keith O. Schmude,
soil scientist, Resources Inventory Division, SCS, Washington, DC

Slide-Tape Programs Available on Snow Control and Windbreaks

Two slide-tape programs were recently made available through Colorado State University in Fort Collins, Colo. The first, titled "The Snows of Winter: An Untamed Resource," depicts research results on snow control for water augmentation on crop and range lands. Research covered was done in Montana, North Dakota, South Dakota, Colorado, and Canada. This program is sponsored by USDA's Agricultural Research Service.

The second program, titled "Windbreaks: Protection for Today, A Legacy for Tomorrow," illustrates farmstead and livestock windbreak planning, planting, and care. Benefits of tree plantings for livestock, homes, and wildlife are emphasized through interviews with landowners.

Both programs, authored by Dr. Dale L. Shaw of Colorado State University, are designed for landowner audiences. The snow management program runs for 19 minutes; the cost is $60. The windbreak program runs for 25 minutes and costs $90. Programs may be ordered from Audio–Visual Service, A–69 Clark Building, Colorado State University, Fort Collins, Colo. 80523.

Pictured on a Poster

"If we had held a contest, we couldn't have picked a better farm family," said James Olson, Soil Conservation Service State conservationist in Pennsylvania. The occasion was a York County recognition program for the Jack Myers family of Dallastown. The Myers' farm was pictured on the National Wildlife Federation's 1985 National Wildlife Week poster. The Federation selected "Soil —we can't grow without it" as its theme for 1985.

SCS presented the Myers family with two enlarged photographs of their farm at a meeting in the York County Commissioners office. Later that day, television crews from Harrisburg and Lancaster visited the farm to film news features. The next weekend the National Wildlife Federation hosted the Myers' visit to Washington, DC, where they were guests of honor at the opening session of the Federation's annual convention, held during National Wildlife Week.

Jack Myers made a hit at the Washington program when he presented Peter C. Myers, then SCS Chief, and National Wildlife Federation officials with tubes of the highly valued topsoil from his farm.

Nine generations ago, Jack Myers' ancestors came from Switzerland to settle on this farm.

When asked by a television reporter why he used soil conserving practices, Jack said, "I want this farm to be as good or better for the next nine generations. Just like the poster says—you can't grow without it."

The Myers family farms 200 acres, raising all the feed for 100 beef cattle. They also raise poultry and grow vegetables. For the past 50 years, the Myers have sold their farm products at two farmers' markets in York.

Nancy Myers commented at the York County presentation, "Little did I realize what I was getting into when I told those two SCS fellows [Photographer Tim McCabe and Public Affairs Specialist Fred Bubb] they could walk and drive around our farm taking pictures."

She added, "When they brought an advanced copy of the poster, I was so proud I could hardly keep back the tears. Sometime ago, we had a visitor from Switzerland who told us our little valley was the prettiest place on earth. I always thought Switzerland was. I guess when you're around it all of the time, you don't fully appreciate it."

Along with the contour stripcropping evident in the poster photograph, the Myers have installed other conservation practices, such as diversion terraces and grassed waterways. They stand as testimony to the Myers' appreciation of their soil.

Frederick E. Bubb,
public affairs specialist, SCS, Harrisburg, Pa.

Photo by Tim McCabe, photographer, SCS, Washington, DC

Irrigation Water Management

Checkbook Method of Irrigation Scheduling

Experimenters in Wyoming have developed an irrigation-scheduling method that is as simple as balancing a checkbook. By keeping a simple record of certain conditions, irrigators can use this "checkbook method" to determine when to irrigate and how much water to apply.

Irrigation scheduling is necessary to prevent over-irrigation or under-irrigation. Over-irrigation is a sure way to waste water, increase erosion, lower crop production, and waste energy. On the other hand, under-irrigation results in crop stress and also lowers production.

In many parts of the country, irrigators rely on commercial irrigation-scheduling firms. In Wyoming, however, such firms have found it difficult to operate economically because there is only a small amount of highly productive agricultural land. For the most part, irrigators in Wyoming must use irrigation-scheduling methods that they can operate themselves.

More than 20 irrigators in the State are now using the recently developed checkbook method of irrigation scheduling. These farmers mostly grow alfalfa and malt barley with center-pivot irrigation systems.

With the checkbook method, the irrigator keeps a record of the amount of moisture in the soil similar to the way most people keep a record of the amount of money they have in a bank checking account. The irrigator fills in the daily maximum temperature, amount of precipitation, and the net amount of irrigation water applied. This information is combined with other information on water use, effective rainfall, and available moisture to determine when to irrigate and how much water to apply. The checkbook method also predicts when the next irrigation will be required, a feature that allows irrigators the time needed to prepare.

The checkbook method was adapted for use in Wyoming by a group of University of Wyoming researchers, University Extension workers, and Soil Conservation Service engineers. This group worked together in a project supported by research grants to the Agricultural Engineering Department of the University of Wyoming.

The group first selected several promising irrigator-operated scheduling methods for testing on the basis of (1) availability of information to the irrigator, (2) reliability, (3) simplicity, (4) cost of equipment, (5) time required, and (6) acceptability by users. They tested tensiometers, electrical-resistance blocks, washtub (essentially a cheap evaporation pan), neutron probe, the Penman evapotranspiration equation for use with a hand calculator, and a checkbook method developed at North Dakota State University.

After a year of testing, the group decided the best method was an adaptation of the checkbook method. To adapt this method to Wyoming, several irrigators field tested the method during the 1983 growing season so that additional modifications could be made. The University of Wyoming's Agricultural Experiment Station then produced a publication that shows irrigators how to use the method.

The publication provides information on crop root-zone depths, soil-moisture depletion rates, and water-application efficiencies. It also presents a method to estimate effective precipitation and a chart to determine available moisture by the feel (texture) and appearance of the soil.

The irrigator must obtain crop water-use tables from local offices of the Agricultural Extension Service or SCS. These offices can also provide additional assistance in setting up a checkbook method.

Betty D. Holbrook,
former public affairs specialist, SCS, Casper, Wyo.

Goshute Indians Improve Irrigation System

Even in a high-water year, the Goshute Indians in Tooele County, Utah, used to lose most of their irrigation water before it reached the land. Now about 75 percent of the diverted water reaches the land.

The Goshutes are more than halfway through a project to improve their irrigation system on the Skull Valley Indian Reservation. They are installing a gravity-pressure system to irrigate about 300 acres of cropland and residential gardens in an area that normally receives 7 to 8 inches of rainfall each year.

Water is obtained from a stream on the reservation. With financial assistance from the Bureau of Indian Affairs of the U.S. Department of the Interior and technical assistance from the Soil Conservation Service, the Goshutes are replacing a flood-irrigation system that lost—mostly through seepage—50 to 75 percent of the water during normal or high-water years and all of the water during low-water years.

The old system was used for irrigating about 50 acres of alfalfa and small grain. Water was diverted from the stream through an earthen canal to a holding pond. The water is still applied by flooding, pending completion of the project, but the earthen canal and holding pond have been replaced with structures that are more efficient.

At a cost of $75,000, the Goshutes constructed a new holding pond and installed a 2¾-mile conveyance pipeline from the stream to the pond. Another $42,000 has been set aside for construction of 2 miles of distribution pipeline from the pond. When finished, the new system will provide sprinkler irrigation on cropland and surface irrigation for home gardens. Some pasture will also be irrigated.

Beverly J. Miller,
public affairs specialist, SCS, Salt Lake City, Utah

Irrigators Reducing Salt in Arkansas River

Improved irrigation systems can do more than save water. In southeast Colorado, they are reducing salt buildup.

Salt buildup is an age-old problem where farmers irrigate. As more and more water is diverted to the soil, salt becomes more concentrated in both the soil and the water supply. Water that evaporates leaves salt behind; water that eventually runs back to the water supply carries salt with it.

Nowhere in Colorado is salt buildup more of a problem than in the Arkansas River Valley. "For at least the past 10 years I have been concerned about the increasing salinity effects on crop production," said Jim Rogers, who irrigates his farm near Lamar with water from the river. "Salinity has caused me to change my farming operations in crop selection, irrigation methods, and fertilization."

Rogers said he can't irrigate for more than 12 hours at a time because of the salinity. "Get it on quick and get it off quick," he said, "that is the only way to keep from over-irrigating. Of course, different soils would irrigate differently. This might not work for my neighbors."

To reduce the concentration of salts in the area, USDA's Soil Conservation Service and Agricultural Stabilization and Conservation Service (ASCS) are targeting a salt cleanup program that consists mainly of improving the efficiency of existing irrigation systems.

"By lining ditches with concrete and replacing eroded earthen ditches with buried pipe, we hope to cut in half the amount of salt reaching the river from agricultural activity," said SCS State Conservationist Sheldon G. Boone.

SCS is also working with ranchers to improve the management of rangeland in the watershed. Rangeland that has been mismanaged for a long time can contribute to salinity and sedimentation of the river because it has poor vegetative cover, low production, and high rates of runoff and erosion.

Much of the problem starts just west of Canon City at the mouth of the Royal Gorge. According to one study, salt content in the river doubles as it flows east from the Royal Gorge to a point just 10 miles downstream. The river travels through geologic formations of Pierre Shale that contribute at least 85 percent of the salt in the river at this point.

"There's very little that can be done to change this geologic erosion and salt buildup," said Rich Romano, SCS soil conservationist at Canon City, "but we are working to reduce the salinity increase caused by irrigation. By lining ditches we can also benefit the farmer by doubling the amount of water arriving at his field. Most of these old ditches lose 50 percent of their water to seepage.

"We've noticed a big improvement already," Romano said. "Before the ditches were lined with concrete, alfalfa fields had seepage areas in many spots. Now, they're pretty well dried up and growing a good crop."

One critical area that is receiving concentrated efforts is near Florence, where an irrigation company serves 91 landowners who farm, mostly on a part-time basis, a total of 600 acres. About half of this land is out of production because of seepage or salt damage. When planned improvements are completed, most of this land should come back into hay production.

Beaver Park is another critical area. Concrete ditch linings and water-management improvements are being installed on irrigated pastures, apple orchards, and vineyards.

"These rejuvenated irrigation systems will definitely reduce the amount of salt going into the Arkansas River," said Romano, "which should help irrigators downstream. For each ton of salt we keep out of the river up here, the benefits are multiplied many times downstream because as water is reused the salts become more concentrated."

SCS targeted $300,000 in fiscal year 1984 for technical assistance to the area, and ASCS targeted $241,000 for cost-sharing. SCS targeted another $117,000 for cost-sharing under the Great Plains Conservation Program.

Jerry D. Schwien,
public affairs specialist, SCS, Denver, Colo.

At left, the Arkansas River flows through highly saline Pierre Shale east of Canon City, Colo. Within a 10-mile stretch the salt content of the river doubles.

At right, some soils become so salty that landowners abandon the thought of growing alfalfa and other crops, and weeds invade the land.

Irrigation Scheduling Saves Water

Improved irrigation scheduling last year saved Utah farmer Carl Probert more than 1,000 acre-feet of water.

Probert is an irrigation farmer in the Scipio Valley, an agricultural area that receives about 10 inches of rainfall each year. Most of the farms in the valley are smaller than 200 acres and are irrigated during the summer with water from snow melting in the central Utah mountains.

The spring of 1984 was unusually wet in the valley because of a record-breaking deep snowpack in the mountains. Probert and his neighbors had to delay planting their corn for several weeks until their fields were dry.

Probert's neighbors began irrigating their crops in June, as usual. Probert, however, was having doubts about whether to irrigate. His corn was growing well and didn't appear to need water.

For advice on what to do, Probert requested assistance from the Soil Conservation Service. He is a cooperator with the Millard County Soil Conservation District and knew that SCS had targeted the area with additional assistance for improving irrigation water management (IWM).

Monte Turner, an SCS soil conservationist who was serving as an IWM team leader, went out to Probert's farm for an onsite investigation. Using the feel-and-appearance method of determining soil moisture with a hand auger, Turner found that there was ample moisture for at least another 2 weeks. He advised Probert to delay irrigating.

Two weeks passed. There had been no rain, but Probert's corn was still growing well and showed no signs of needing water. Turner and the IWM team returned to the farm, again checked the soil, and again found that Probert's corn had all the moisture it needed.

Finally, 2 months into the irrigation season, as several area farmers were beginning to tease Probert for not irrigating, Turner discovered the source of the moisture. The water table in the area was unusually high. When the fields above Probert's corn were irrigated, the water table on Probert's farm rose enough to subirrigate Probert's corn below the soil surface and still leave ample room for root growth and aeration.

Probert's corn grew all summer without needing any irrigation, allowing him to skip four watering turns and save 1,008 acre-feet of water, plus time and labor. At harvest, he chopped the corn for silage and obtained more than 29 tons per acre, a yield considerably higher than those of most of his neighbors who had irrigated as always.

"Carl Probert allowed us to use his farm to demonstrate to other farmers the advantages of better irrigation scheduling," said Turner. "In addition to his corn, we also augered several fields of alfalfa for him. Only two of his fields that we augered needed to be irrigated during the entire irrigation season."

In all, the IWM team working out of the SCS field office in Fillmore, and in cooperation with five conservation districts, provided irrigation assistance to more than 65 farmers in Beaver, Juab, and Millard Counties. It provided technical assistance on about 25,000 acres of irrigated farmland. More requests for assistance are anticipated this year.

Robert L. Newhall,
soil conservationist, SCS, Fillmore, Utah

City Benefits From Irrigation System

Casper, Wyo., will get more water by helping an irrigation district save more water.

The City of Casper, population about 50,000, and the Casper-Alcova Irrigation District are making a joint effort to improve the district's Kendrick Irrigation Project. When completed, the improvements should reduce annual water loss by 7,000 acre-feet. The water saved will then be sold to the city.

The Kendrick Irrigation Project includes a main canal 62 miles long and lateral ditches that total 140 miles. It receives approximately 64,318 acre-feet of water each year from the North Platte River. Water from the project flows to 479 individuals who irrigate a total of 24,265 acres in parcels ranging from ½ acre to 1,822 acres.

Faced with accelerating expansion and a pressing need for more water, the city suggested the joint venture to the irrigation district. The parties then requested technical assistance from George Davis, district conservationist with the Soil Conservation Service.

Davis and his staff conducted a survey and determined that the project was feasible. The city, the irrigation district, SCS, and the Casper-Alcova Conservation District then developed a 15-year plan to improve the system. This plan is to be updated annually.

Next in the process, an Environmental Impact Statement was completed and the State issued a secondary permit allowing the irrigation district to transfer water to the city for domestic use. The Wyoming State engineer must approve all transfers of water saved as a result of this project. The city and the irrigation district then entered into a contract administered by the Bureau of Reclamation of the U. S. Department of the Interior, which installed the original system.

The city paid the irrigation district $750,000 when the contract was signed in 1982 and will contribute $150,000 annually until 1997, when all scheduled improvements should be completed. The city will also pay $24 per acre-foot of water used annually.

Since it is not practical to install water-saving structural measures on all 202 miles of canals and open ditches in the system, the project was divided into 132 segments. Measures will be installed on those segments where investigation indicates the most water can be saved per dollar invested.

By using infrared aerial photography and SCS soils information, it was possible to estimate the amount of water being lost in the various segments. The segments were then ranked in priority for further field studies to determine actual seepage losses.

The irrigation district hired two hydrologists to conduct the field studies. Recording stations are being used to measure inflow and outflow on the different laterals. New turnout weirs were installed and old ones rehabilitated for more accurate measurement of water delivered to individual fields.

Based on the field studies conducted during the first 2 years, some pipelines and

concrete-lined ditches have already been installed on several segments. The irrigation system is expected to begin making water available to the City of Casper by the middle of 1985.

The cooperation of city, State, and Federal agencies on this project has resulted in an increased water supply for the city, improved irrigation water management, reduced saline seep areas, preserved farmland, preserved wetland wildlife areas, and reduced wet saline spots in fields for better production. The more efficient delivery of water has also encouraged some irrigators to invest the money necessary to replace flood irrigation with improved systems. This will further conserve water and reduce soil erosion on the irrigated cropland.

Betty D. Holbrook,
former public affairs specialist, SCS, Casper, Wyo.

Irrigation Project Replaces Leaky Pipe

For 50 years, a 60-inch corrugated metal pipe siphon had carried irrigation water for operating units served by the Big Goose-Soldier Creek Irrigation Group in Sheridan County, Wyo. In those 50 years, the siphon had developed so many leaks it was estimated that more than 30,000 bolts were being used to plug the holes. One landowner remarked, "When the siphon was full, it had so many leaks it looked like a lawn sprinkler."

In the fall of 1982, to improve irrigation efficiency, the Big Goose-Soldier Creek Irrigation Group, a cooperator with the Clear Water Conservation District, requested assistance from the Soil Conservation Service in designing a new siphon to replace 550 feet of the leaky one.

After his initial survey, SCS Civil Engineering Technician Al Destefano determined that the 60-inch corrugated metal pipe could be replaced with 36-inch smooth pipe to carry the needed 40 cubic feet of water per second. The SCS design not only reduced pipe size, improved efficiency, and cut installation costs, but it also called for replacement of the inlet and outlet structures of the siphon, which had started to crumble and leak. The design included a drain, 2,000 feet of ditch reorganization, critical area seeding, and 150 feet of 60-inch buried corrugated metal pipe at the outlet end. The 150 feet of buried pipe was needed to prevent slippage along the steep hillside downstream from the outlet.

The new siphon carries water to 20 operating units covering 2,800 acres. The project was completed in January 1983 at a cost of $17 an acre. The Agricultural Stabilization and Conservation Service cost-shared about 44 percent of the total cost.

Keith Covington,
district conservationist, SCS, Sheridan, Wyo.

Sioux Tribe Completes Irrigation Project

The Standing Rock Sioux Tribe is gearing up for agricultural development south of Fort Yates, N. Dak., with a new irrigation system.

The system uses eight center pivots to irrigate 821 acres of soybeans, corn, and alfalfa on the tribe's Standing Rock Farms along the Oahe Reservoir. The tribe plans to expand this operation into an integrated farm enterprise by using the crops for feed and to raise reinvestment capital.

The system has three water pumps, 3¼ miles of pipelines, a weather station, a fertilizer-injection system, and a computer-radio control system. It was completed in 1983 at a cost of $1,041,600.

Funds and survey assistance for the irrigation project were provided by the Bureau of Indian Affairs of the U.S. Department of the Interior. The Soil Conservation Service designed the system and supervised construction.

Brenda Johnson,
visual information specialist, SCS, Bismarck, N. Dak.

International Congress to Focus on Drip/Trickle Irrigation

The latest worldwide developments in research, equipment, applications, and adaptation of drip/trickle irrigation will be presented at an international congress this fall.

The Third International Drip/Trickle Irrigation Congress is scheduled for November 17–21, 1985, in Fresno, Calif. It will be held concurrently with the 1985 International Irrigation Exposition and Conference, which will have 400 exhibit booths.

Some of the session titles of the congress are economic considerations, crop production and response, field evaluation of drip/trickle systems, product testing and evaluation, drip/trickle irrigation design, crop growth and response to trickle irrigation, drip/trickle irrigation with saline water, soil and infiltration factors, subsurface drip/trickle irrigation, and irrigation scheduling and water management. Research and field tours are planned.

A program for the Third International Drip/Trickle Irrigation Congress can be obtained by contacting Loretta Dibble, American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, Mich. 49085-9359.

Details on the 1985 International Irrigation Exposition and Conference can be obtained from The Irrigation Association, 13975 Connecticut Avenue, Silver Spring, Md. 20906-2976.

The third International Drip/Trickle Irrigation Congress is sponsored by the American Society of Agricultural Engineers and is cosponsored by The Irrigation Association. The Soil Conservation Service is a cooperating organization.

CONSERVATION Research Roundup

Earthworms Poke Holes in Irrigation Theories

Idaho farmers who surface-irrigate have long noted an oddity in the movement of water down their furrows. Sometimes, after a few hours, the water "backs up" the furrows, no longer moving all the way to the end thus threatening yields at the bottom of the fields.

According to Thomas Trout, an agricultural engineer with USDA's Agricultural Research Service, the previously elusive explanation may be earthworms.

Trout said that last summer he and colleague Gary Johnson took careful measurements of water movement in furrows at the Snake River Conservation Research Center at Kimberly, Idaho. Their measurements confirmed their suspicion that something odd was happening.

Then, when they talked with area farmers, they learned that every one of them had the same problem—some in all fields, some on just a few fields.

"What happened was that the rate the soil absorbed water increased as the soil became wetter during an irrigation event," said Trout. "You will never find this in any theory of water flow through soils—because it can't happen in theory."

Suspecting earthworms, they evaluated furrows at the research center and found that earthworm tunnels were having a "sieve effect."

Water was flooding into the earthworm holes that had appeared in the furrows while irrigation was in progress, then pouring into a mass of underground channels. Trout said these channels took in "maybe two or three times as much water" as would normally infiltrate into the furrow.

"It doesn't take a lot of earthworms breaking out into furrows to cause a major increase," he said.

Trout and Johnson completed the study by measuring furrows on 28 farmers' fields in the Twin Falls area, with similar results. Johnson said it was not unusual to see 150 wormholes in a 10-foot furrow section after a 24-hour set. In one 10-foot section, earthworms had increased the infiltration rate sixfold.

Trout said the problem increased later in the season as the worms extended their burrows into the plowed soil layer and the furrows' surface became firmer.

Trout said he and Johnson have "no doubt that earthworms surface in furrows and that their holes take in water. But we still haven't proved conclusively that earthworms are the major cause of backing up of irrigation water in furrows."

For more information, contact Trout or Johnson at the USDA–ARS Snake River Conservation Research Center, Route 1, Box 186, Kimberly, Idaho 83341.

Save Energy: Irrigate From a Bottle

When John Oertly gave his ranch manager Steve Denis the go-ahead to install an irrigation system that is virtually untested in this country, he didn't realize that it might pay for itself in a surprisingly short time. But the unique system, which was originally developed in Israel, is slashing energy costs for the Coachella Valley, Calif., citrus grower.

The HYT (for hydro-transformer) irrigation system is the brainchild of Gideon Ruttenberg. What makes Ruttenberg's system unique is that it can operate on gravity alone in some situations, and with very low energy costs in virtually all situations. He began developing it about 15 years ago and already has patents in several countries; a U.S. patent is pending.

"When we put the HYT system in about 6 months ago, 10 percent of our trees seemed to be dying and another 75 percent were in trouble," Denis said. "The HYT system has proven to be a far more efficient way to apply water than we expected. We believe that once we change our pump and filters to low pressure, we will realize a 60-percent cost savings in energy over other forms of irrigation."

A key part of the HYT system is a 1-liter polyethylene bottle fitted with a nozzle in its cap. A bottle is attached to each tree. When the system is on, water flows continuously through the nozzle, filling the bottle. Once the water level in the bottle nears the top, the capillary rise of the liquid causes a siphoning action to occur. The contents of the bottle are then dumped onto the soil surface through a small plastic tube. This tube extends from the bottle and is coiled around the base of the tree. The tubing has five or six small orifices that allow the water to spurt out onto the soil surface. Regulating the amount of water each tree receives is merely a matter of timing the irrigation period. A timer on the booster pump is all that is needed. For instance, if the goal is to give each citrus tree 120 gallons of water a day, the system could be operated over a 24-hour period at 5 gallons per hour (gph) per tree. There is also a 2.5-gph nozzle available that allows an operator to apply 60 gallons over a 24-hour period.

According to Denis, it would cost $10,331 to pump water to the 100-acre citrus grove (including standby charges of $25.80 per hp per year). With the HYT system, Denis estimates the pumping costs to be only $5,910, a savings of $4,421 per year.

Sam Aslan, Soil Conservation Service district conservationist at Indio, tested the installation for efficiency. He reported that the field test showed an emission uniformity of 91 percent. Aslan said that a rating of 90 percent is considered excellent, while 80–90 percent would be good.

"Since the system operates on low pressure and low flow, very little energy is consumed," Ruttenberg explained. In a mini-sprinkler system, pressure is used to create a large wetted zone around the tree. Normally, a mini-sprinkler operates with 30 pounds per square inch at the sprinkler.

In drip, pressure is also used to get even distribution, with 14–20 psi being used at the dripline.

Ruttenberg estimates the cost of installing his design at $700 to $900 an acre, depending on the number of acres being put under the system. This price would also include a small booster pump. If his calculations are correct, it would be possible to save as much as $7,000 a year on energy alone on an 80-acre installation. Little wonder that he and Oertly are excited about the possibilities of the system.

Agricultural Chemicals May Contaminate Ground Water Sooner Than Expected

Pesticides and other chemicals present in farm irrigation water may move through the soil to reach underlying ground water more rapidly than previously supposed, according to Dr. Robert Bowman, soil scientist with the U.S. Department of Agriculture's Agricultural Research Service (ARS) in Phoenix, Ariz.

"We're finding that, under wet soil conditions, water is moving downward about twice as fast as many of our theoretical models have predicted," said Bowman. In addition, ARS Agricultural Engineer Robert Rice, working with drier soil conditions more typical of Arizona, has found downward water velocities four to five times in excess of predicted values.

Since harmful agricultural chemicals and residues move downward primarily with water which leaches through the soil, ground water pollution problems resulting from farm practices will likely appear sooner than previously expected, the researchers said.

For more information, the researchers can be reached at the USDA-ARS Water Conservation Laboratory, 4331 East Broadway Road, Phoenix, Ariz. 85040.

Traveling Trickle System Makes Water Go Further

U.S. Department of Agriculture researchers use computerized technology to water acres of plants without having to lift a finger. Claude J. Phene, a soil scientist with USDA's Agricultural Research Service, Water Management Research Laboratory in Fresno, Calif., has developed a new watering system that reacts automatically to thirsty plants.

Weather station instruments, infrared thermometers, and other monitors tell Phene's system when to irrigate the plants and how much is needed. What happens next is something gardeners only dream about. On a signal from a computer, a watering system travels along the crop rows, stops, and does its job—without anyone having to trudge up and down the rows to open and close valves or do other watering chores.

Phene's system uses towers on wheels to carry waterlines 10 feet in the air over crop rows. Water is metered into tubes that reach down within inches of the plants. No water is wasted—either through percolation deep into the soil or runoff between rows. At the same time the watering is done, the system can apply fertilizer, insecticide, and herbicide to the plants. Phene said his technology package—called the traveling trickle irrigation system—has one purpose: to make scarce water go further in farming areas that depend on irrigation.

On some farms, computers are doing that to some degree. But the new system brings into play other state-of-the-art technologies to ensure that plants are well cared for.

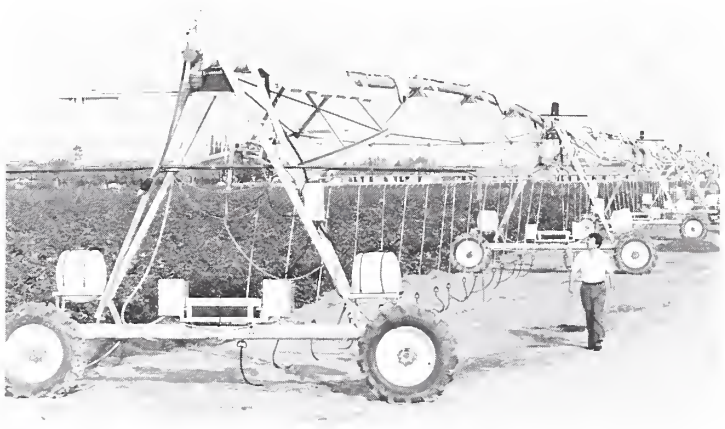
A main computer orchestrates all the operations, making the system fully automatic. Sensors monitor soil moisture and water given off by the plant to gauge exactly when plants need water; all data are computerized. Lasers guide the system, keeping the towers in the field perfectly aligned with the main tower that houses the central computer and a pump. Infrared thermometers travel atop the towers to measure and record foliage temperatures. Again, the readings are computerized. Photovoltaic solar cells supply power for moving the towers over the field and to other fields. Cells also may replace standard electrical power for pumping water. A computerized weather station records solar radiation, wind, air temperature, and humidity. A mulcher attachment is used at cultivating time to make slits in the soil between plant rows. It then automatically fills the slits with peat moss and sawdust to increase infiltration of water into the soil.

Originally, Phene pieced together a working model from spare parts for research purposes—mainly for experiments on eliminating water that is wasted in irrigating crops. He then worked out a technology package to go on a commercially built irrigation system that travels along the rows. He expects that by adapting the technology, the system could be used almost anywhere crops are irrigated, especially row crops. Almost 61 million acres of cropland are irrigated—including 85 percent of the land in Western States.

So far, the system has worked well on tomato and cotton test fields in California. Phene and researchers at California State University at Fresno and the Center for Irrigation Technology are cooperating in tests to make the system even stingier in using water.

A typical system costs about $550 an acre, based on a 250-acre field. Phene said the cost could decrease as more systems are used. "The system takes the guesswork and any human bias out of irrigating," he said. "We need to use every available drop of water, especially in the semi-arid West."

Dr. Phene can be reached at the USDA-ARS Water Management Research Laboratory, 2021 South Peach Avenue, Calif. 93727.



ARS Soil Scientist Claude Phene checks the computerized irrigation system at the Water Management Research Laboratory in Fresno, Calif. It is guided by lasers, reacts to plant water needs, runs on solar power, and takes plant temperatures.

New Publications

Emergency Action Planning Guidelines for Dams

by the Subcommittee on Emergency Action Planning of Interagency Committee on Dam Safety

The purpose of this 27-page booklet is to encourage thorough and consistent emergency action planning for levels of preparedness which may save lives and reduce property damage in areas affected by dam operation or failure. This booklet provides dam owners and communities specific guidance on the development of emergency action plans. It includes an outline of what information an emergency action plan should contain and a checklist for dam emergency plans.

For information on how to order a copy of this booklet, contact the Director of Engineering, USDA, Soil Conservation Service, P. O. Box 2890, Washington, DC 20013–2890.

Long-Throated Flumes and Broad-Crested Weirs

by M. G. Bos

For effective water management, it is vital to have structures that can measure the rate of flow in a wide variety of canals and streams This book explains the steps to be taken to arrive at a procedure that can yield the hydraulic dimensions and the rating table of the appropriate weir or flume to measure the flow rate in any channel.

The beginning of this book introduces the long-throated flume and the broad-crested weir and explains why these structures can meet the boundary conditions and hydraulic demands of most measuring sites. It also gives the history of long-throated flumes and broad-crested weirs.

Many graphs, tables, and charts are used throughout to enhance the text.

For a copy of this book, send $35.40 to Kluwer Academic Publishers, 190 Old Derby Street, Hingham, Maine 02043.

Flow Measuring Flumes for Open Channel Systems

by Marinus G. Bos, John A. Replogle, and Albert J. Clemmens

Increasing emphasis on properly managing our dwindling water supply requires more and better measurements of flows in irrigation canals, drains, natural streams, and sewers. In this book, the authors are attempting to put the measurement of flow on a solid scientific foundation by developing a sound theory of water flow through long-throated flumes. Based on this theory and with much experience in adapting these structures to irrigation and watershed uses, they have chosen a number of measuring structures that are most suitable to existing water management needs.

All structures mentioned in this book resemble the long-throated flume and the hydraulically related broad-crested weir. Of all known flumes and weirs, these structures have several major advantages.

This book is organized so that relatively inexperienced users can quickly understand the basic concepts and can design flumes for immediate use. More experienced users can use the theoretical sections of the book to custom design complex shapes for special channel situations.

Copies of this 321-page book are available for $42.95, plus postage and handling, from John Wiley & Sons, Inc., One Wiley Drive, Somerset, N.J. 08873.

Measuring the Benefits of Clean Air and Water

by Allen V. Kneese

Citizen concern about environmental deterioration brought on by the heightened economic development of the 1960's and 70's led to the passage of Federal laws aimed at improving the quality of the environment. Today many question whether these environmental regulations are still affordable or even necessary.

For the past few years, the author and his colleagues have been applying the principles of cost-benefit analysis to questions of environmental quality. The first part of this five-part book is a presentation of basic concepts and methods which underlie the case studies in parts II and III. Part II gives the results of the case studies in urban air pollution and part III in rural and regional air and water pollution. The author finishes with some concluding notes and a bibliography and index.

This 140-page paperback is available for $5.95 from Resources for the Future, P. O. Box 4852, Hampden Station, Baltimore, Md. 21211.

Field Drainage: Principles and Practices

Edited by D. A. Castle, J. McCunnall, and I. M. Tring

Although many books and papers have been written on various aspects of field drainage, the majority have a theoretical approach. The aim of this book is to put theory into practice. It shows the reader how to design a field drainage system by identifying the drainage problem; carrying out the site inspection and soil examination; deciding on the drain layout, depth, and spacing; and determining the pipe sizes. Sections are devoted to pumped drainage systems, mole-drainage and subsoiling, workmanship and materials, and problems such as ochre and salinity. The concluding chapters deal with the use of maps and plans, and with legislation and conservation.

This 250-page book is directed toward the practitioners of drainage design and installation such as farmers, field drainage contractors, and drainage consultants. Students of field engineering will also find this book useful in their studies.

Copies are available for $34 from David & Charles, Inc., North Pomfret, Vt. 05053.

Glossary of Soil Science Terms

by the Soil Science Society of America

This newly revised edition contains some 1,200 terms defined in an effort to provide a foundation for common understanding and communications covering soil science. This revision incorporates a new policy that all acceptable terms be published in one alphabetical listing. Included in this publication are appendixes listing obsolete terms, tabular information, a procedural guide for tillage terminology, and new designations for soil horizons and layers.

Also in this edition are revisions or new terms developed since 1979 by terminology committees covering soil fertility and plant nutrition; soil genesis, morphology, and classification; soil and water conservation and management; and forest and range soils.

Copies are available for $3 (for one to five copies) or $2.75 (for six or more copies) from Soil Science Society of America, 677 South Segoe Road, Madison, Wis. 53711.

Recent Soil Surveys Published

by the Soil Conservation Service

Florida: Charlotte County.
Illinois: Henry County.
Missouri: Jackson County and Platte County.
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